# DRAFT CORRECTIVE ACTION DECISION

## Coleman Northeast Site
## 3600 North Hydraulic Street
## Wichita, Kansas
## Project Code: C2-087-00678

Prepared by:

Kansas Department of Health and Environment
Division of Environment
Bureau of Environmental Remediation
Curtis State Office Building
1000 Jackson St, Suite 410
Topeka KS, 66612

August 2018

# TABLE OF CONTENTS

TABLES



FIGURES

## Acronyms and Abbreviations Used in This Document

| | |
|---|---|
| ARARs | Applicable or Relevant and Appropriate Requirements |
| ATG | Alternative Treatment Goal |
| bgs | below ground surface |
| CAD | Corrective Action Decision |
| CAS | Corrective Action Study |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| COC | Contaminant of Concern |
| DCA | Dichloroethane |
| DCE | Dichloroethene |
| ERD | Enhanced Reductive Dechlorination |
| EUC | Environmental Use Control |
| IRM | Interim Remedial Measure |
| ISCO | In Situ Chemical Oxidation |
| KDHE | Kansas Department of Health and Environment |
| MCL | Maximum Contaminant Level |
| µg/kg | micrograms per kilogram |
| µg/L | micrograms per Liter |
| MNA | Monitored Natural Attenuation |
| NCP | National Contingency Plan |
| NIC | North Industrial Corridor Site |
| PCE | Tetrachloroethene |
| RAO | Remedial Action Objective |
| RSK | Risk-based Standards for Kansas |
| SVE | Soil Vapor Extraction |
| TCE | Trichloroethene |
| VOC | Volatile Organic Compound |

## Glossary

**Administrative Record (AR)** – The body of documents that form the basis for selection of a particular response at a site. Parts of the AR are available in an information repository near the site to permit interested individuals to review the documents and to allow meaningful participation in the remedy selection process.

**Air Stripping** – The process of forcing air through polluted water to remove harmful chemicals. The air causes the chemicals to change from a liquid to a gas. The gas is collected and treated if necessary.

**Aquifer** – An underground layer of rock, sand, or gravel capable of storing water within cracks and pore spaces or between grains. When water contained within an aquifer is of sufficient quantity and quality, it can be used for drinking or other purposes. The water contained in the aquifer is called groundwater.

**Applicable or Relevant and Appropriate Requirements (ARARs)** – The federal and state environmental laws that a remedy will meet. These requirements may vary among sites and alternatives.

**Corrective Action Decision (CAD)** – The decision document in which KDHE selects the remedy and explains the basis for selection for a site.

**Corrective Action Study (CAS)** – A study conducted to evaluate alternatives for clean-up of contamination.

**Enhanced Reductive Dechlorination (ERD)** – the process of enhancing a reducing environment by injecting a carbon substrate into the subsurface to assist anaerobic microbes in cleaning up contaminants.

**Exposure** – Contact made between a chemical, physical, or biological agent and the outer boundary of an organism. Exposure is quantified as the amount of an agent available at the exchange boundaries of the organism (e.g., skin, lungs, gut).

**Groundwater** – Underground water that fills openings in rocks or pores in soils to the point of saturation. Groundwater is often used as a source of drinking water via municipal or domestic wells.

**Hydraulic Containment** – Use of pump and treat groundwater remediation systems to hydraulically control the movement of contaminated groundwater in order to prevent continued expansion of the contamination zone.

**In Situ Chemical Oxidation (ISCO)** – the process of using chemicals called "oxidants" to help break down harmful contaminants in place through injections into the subsurface.

**Maximum Contaminant Levels (MCLs)** – The maximum permissible level of a contaminant in water that is delivered to any user of a public water system.

**Monitoring** – Ongoing collection of information about the environment that helps gauge the effectiveness of a cleanup action. For example, monitoring wells drilled to different depths at the site would be used to detect any migration of the plume.

**Monitored Natural Attenuation (MNA)** – Allowing natural processes to remediate pollution in soil and groundwater while site conditions are routinely monitored.

**National Oil and Hazardous Substances Pollution Contingency Plan (NCP)** – The federal regulations that guide the Superfund program. These regulations can be found at 40 Code of Federal Regulations, Part 300.

**Plume** – A body of contaminated groundwater flowing from a specific source.

**Risk** – The probability of adverse health effects resulting from exposure to an environmental agent or mixture of agents.

**Site** – The Coleman facility as described in Paragraph 2.1 and identified in Figure 1.

**Superfund** – Federal authority established by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), to respond directly to releases or threatened releases of hazardous substances that may endanger health or welfare. Also, the common name given by the press for CERCLA because the program was well funded in the beginning.

**Tier 2 Level** – Calculated risk-based cleanup value for a specific contaminant. These values can be found in Appendix A of the *Risk-Based Standards for Kansas (RSK) Manual.*

**Threshold** – The dose or exposure below which no harmful effect is expected to occur.

**Toxicity** – A measure of degree to which a substance is harmful to human and animal life.

**Vapor Intrusion** – The migration of contaminants from the subsurface into overlying and/or adjacent buildings.

**Volatile Organic Compounds (VOCs)** – Carbon compounds, such as solvents, which readily volatilize at room temperature and atmospheric pressure. Some VOCs can cause cancer.

# 1. Purpose of the Draft Corrective Action Decision

The primary purposes of the draft Corrective Action Decision (CAD) for the Coleman Northeast Site (Site) are to: 1) summarize information from the key Site documents including multiple investigation reports and the Corrective Action Study[1] (CAS); 2) briefly describe the alternatives for remediation detailed in the CAS report; 3) identify and describe the Kansas Department of Health and Environment's (KDHE's) preferred remedy for contamination at the Site; and, 4) provide an opportunity for public comment on the preferred remedy.

KDHE will select a final remedy for the Site after reviewing and considering all information submitted during the 30-day public comment period. KDHE may modify the preferred alternative based on new information or public comments; therefore, the public is encouraged to review and comment on the preferred remedy presented in this draft CAD. If during the public comment period a meeting or availability session is requested, one will be held to present information regarding the preferred remedy and solicit public input. The public may submit written comments to KDHE during the public comment period from August 22 to September 21, 2018. Section 9.0 provides more information on the procedures for providing comments on the draft CAD.

Extensive investigation activities and remedial tasks have been performed by Geraghty & Miller, Inc., (G&M) and ARCADIS U.S., Inc. (ARCADIS) on behalf of The Coleman Company, Inc. (Coleman). Work performed during the investigations and CAS process followed the terms outlined in the Consent Order dated March 15, 1992, and the amended Consent Order in 2002[2], between Coleman and KDHE. The public is encouraged to review and comment on the technical information

## Highlight 1-1: Public Information

*Administrative Record File*

Kansas Department of Health and Environment
Bureau of Environmental Remediation
1000 SW Jackson Street; Suite 410
Topeka, Kansas 66612-1367
Contact: Pamela Green
Phone: 785-296-1935
E-mail: pamela.green@ks.gov

Web:
http://www.kdheks.gov/remedial/site_remediation/index.html

*Local Information Repository*

City of Wichita Department of Public Works and Utilities
Environmental Health Division
1900 E. Ninth Street
Wichita, Kansas 67214
Contact: Darren L. Brown, P.G.
Phone: 316-268-8351
E-mail: DLBrown@wichita.gov

[1] ARCADIS, April 29, 2016, *Corrective Action Study, The Coleman Company Northeast Plant, Wichita, KS*, prepared on behalf of The Coleman Company, approved August 10, 2016.
[2] KDHE, November 17, 1992, *Case No. 91-E-205*.

presented in the investigation and CAS reports and other documents contained in the Administrative Record File[3]. The Administrative Record File includes all pertinent documents and Site information that form the basis and rationale for selecting the final remedy. The Administrative Record File is available for public review during normal business hours at the KDHE location shown in Highlight 1-1. Also, as shown, for convenience to interested members of the public, copies of the CAS report and the draft CAD are also available for review and copying during normal business hours at the local information repository located at the City of Wichita's Environmental Health Division Offices. The public may also access the investigation reports, the CAS report, and the draft CAD online at:
http://www.kdheks.gov/remedial/site_remediation/ index.html.

# 2. Site Background

## 2.1 Site Location

The Site is located at 3600 North Hydraulic Street, southeast of the intersection of Hydraulic Avenue and 37th Street North in Wichita, Sedgwick County, Kansas (see Figure 1). The facility occupies approximately 160 acres, which include an office and manufacturing complex on 26 acres (see Figure 2 for the site layout). Properties adjoining the Coleman Northeast Plant are predominantly commercial and industrial. Adjacent commercial and industrial properties to the north include the former Unocal facility and the Wichita School District Service Center. Two additional commercial properties, a petroleum products storage and transfer facility and a natural gas storage and transfer facility, are located north of the Unocal facility. Commercial properties are also located to the east, west and south. The Site is located within the larger North Industrial Corridor (NIC) Site, an area of regional groundwater contamination.

## 2.2 Site History

Facility operations began in 1971, manufacturing recreational equipment including coolers, beverage jugs, cook stoves, and lanterns. A surface impoundment covering approximately seven acres is present near the west property boundary. The impoundment is used for noncontact cooling water associated with the plant operation and for storm-water runoff retention. A permit to operate the impoundment has been issued by the State of Kansas.

The former Unocal facility (Project #C5-087-00431) is located to the northeast and is a source for dissolved chlorinated hydrocarbons that mingle with the Site's volatile organic carbon (VOC) plumes. Two identified plumes migrating onto the Site are currently being addressed by Coleman's hydraulic containment system. The Unocal Site has conducted corrective actions such as Enhanced Reductive Dechlorination (ERD) and is currently implementing phytoremediation and Monitored Natural Attenuation (MNA) under KDHE's Final CAD issued July 16, 2015.

Coleman entered into a Consent Order with KDHE in November 1992 to conduct a site investigation and an evaluation of remedial alternatives.

[3] Administrative Record File #C2-087-00678

# 3. Site Investigations

Numerous Site investigations since 1992 and data obtained during Interim Remedial Measures (IRMs) have contributed to developing the Site conceptual model. Investigative objectives generally include:

- Define and characterize the lateral and vertical extent of potential source areas for contaminants of concern (COCs) in all environmental media;
- Identify all human and environmental receptors that may be affected by contamination; and
- Evaluate IRMs and other potential remedial action alternatives to protect human health and the environment.

## *3.1 Geological and Hydrogeological Setting*

The Site lies at the boundary of the Arkansas River Valley and the bordering Wellington Uplands area. The topography is generally flat to gently rolling toward the west-southwest. In general, the Arkansas River Valley is characterized by a broad flat plain consisting of unconsolidated sediments. Alluvial sediments in the immediate vicinity of the Site range in thickness from 10 feet to 40 feet. The Wellington Upland area located directly east of the Site is composed of loess and fine-grained alluvial deposits underlain by the Wellington Shale.

The unconsolidated deposits underlying the Site can be divided into the following geologic units: 1) Arkansas River Alluvial Valley, 2) the Wellington Upland Area, and 3) the transition zone between the Wellington Uplands and the Arkansas River Alluvial Valley. All three geologic units are underlain by the Wellington Shale.

In general, the lithologic units in the Arkansas River Alluvial Valley area consist of the following fining upward sequence (descending order): soil/fill; silty clay to clay; and fine to coarse grained sand with interbedded gravel layers (alluvial sand) unit. The basal gravel lag deposit is present at the bottom of the alluvial sand unit and is usually situated directly above the Wellington Shale. A clay lens with an approximate thickness of five feet is present at the midpoint of the alluvial sand below Site 1B. The clay lens pinches out in the downgradient direction approximately 200 feet south of the plant fence (immediately north of the monitoring well pair MW16/16D). The gross thickness of the alluvial sediments ranges from 30 to 42 feet of which the alluvial sand unit consists of the bottom 15 feet to 26 feet across the southern and western portions of the Site.

The unconsolidated sediments overlying the Wellington Shale in the Wellington Uplands are comprised of loess deposits, primarily fine-grained alluvial floodplain deposits and colluvial deposits (Lane and Miller, 1965). Approximately 25 feet of unconsolidated sediments were encountered in the Wellington Uplands in the Coleman field east of the railroad tracks. The unconsolidated sediments consist of possible loess deposits, silty clay to clayey sand alluvial deposits and basal colluvial deposits.

Groundwater generally is encountered at depths ranging from 10 feet to 28 feet below ground surface (bgs), flowing southwest as shown in Figure 3. In the northern half of the Site where the Wellington Shale is shallowest, the hydraulic gradient typically ranges between 0.015 and 0.020 feet/feet. The hydraulic gradient decreases southwestward across the Site and ranges from approximately 0.001 to 0.004 feet/feet in the southern half of the Site.

No perennial or intermittent streams traverse the property. Surface runoff east and south of the building flows into an unnamed intermittent tributary to the East Fork of Chisholm Creek via drainage ditches.

### 3.2 Summary of Investigations

The COCs are primarily VOCs, specifically trichloroethene (TCE) and its degradation products. Site media impacted by the COCs are soil and groundwater.

Investigations conducted from 1990 through 1997 identified two source areas with soil and groundwater impacted by chlorinated VOCs. The investigations identified TCE and cis-1,2-dichloroethene (cis-1,2-DCE) as the primary COCs at areas identified as Site 1B and Site 3, where former surface drains discharged from the facility. Site 1B is located at the southeast corner of the facility, and consists of two distinct areas of impact divided by a plant road, and Site 3 is located between the west office building and the west parking lot.

- Phase I Site Investigation, 1991[4]: G&M investigated two possible source areas of contamination to groundwater. They collected soil samples from six borings to a depth of 10 feet at Site 1, which was a satellite hazardous materials storage area. They collected soil samples from seven soil borings to a depth of 14 feet at Site 2, where the degreasing pit and sump inside the building were located. Both Sites were determined to be potential source areas, but G&M did not collect downgradient samples. They collected five groundwater samples. The highest concentrations of COCs were detected adjacent and downgradient of Site 2. TCE, 1,2- DCE, and vinyl chloride showed concentrations in soil well above their respective Tier 2 Risk-based Standards for Kansas (RSK) residential soil-to-groundwater levels. Tetrachloroethene (PCE), TCE, and 1,2-DCE showed concentrations in groundwater above their respective Tier 2 groundwater levels.

- Phase II Site Investigation, 1993[5]: G&M divided the Site into four areas for further source area investigation and COC delineation. Site 1 was divided further into three areas for additional investigation. G&M collected seventy-three groundwater and 194 soil samples from 62 borings, along with 33 surficial samples and 25 monitoring well samples. Floor drain outfalls, particularly the concrete trough and discharge pipe to the ditch at Site 1B, were considered the main source area at Site 1 due to historical TCE

[4] Geraghty & Miller, Inc., 1991, *Phase I Site Investigation, Coleman Northeast Plant, Wichita, Kansas,* August 7.
[5] Geraghty & Miller, Inc., 1993, *Phase II Site Investigation, Coleman Northeast Plant, Wichita, Kansas, October 22.*

releases. The former floor drain pipe outfall is the primary source of COCs at Site 3. Historical releases of TCE inside the plant building were transported through floor drains and discharged on the ground at the outfall pipe. TCE and cis-1,2 DCE were the prevalent contaminants in shallow and deep groundwater samples, with degradation products present in the shallow groundwater samples collected near source areas. Results indicated that TCE degradation occurred preferentially in the immediate vicinity of source areas and that TCE degradation products were less persistent (i.e. shorter half lives) than TCE in the subsurface environment.

- Addendum Phase II Site Investigation, 1994[6]: In 1993 and 1994, G&M conducted aquifer testing, installed new wells, and sampled monitoring wells to evaluate hydraulic properties of the aquifer and to delineate the extent of contaminated groundwater. Three separate areas of groundwater impact were found, two originating in Site 1B and one originating in Site 3. The highest concentration of TCE was 21,000 micrograms per Liter (μg/L), and the highest concentration of 1,2-DCE was 7,200 μg/L, above the Tier 2 RSKs of 5 μg/L and 70 μg/L, respectively.

- Coleman/Unocal Investigation, 1995[7]: Coleman conducted the investigation concurrently with Unocal beneath the Coleman shipping warehouse to determine the upgradient extent of VOCs detected on the northwest side of the building. Analytical results showed that VOCs were detected in groundwater beneath the entire width of the building, which decreased downgradient (southwest) from the eastern portion of the shipping warehouse. The investigation found that a Unocal plume extends beneath the Coleman building and commingles with the Coleman plume originating from Site 3. They determined that PCE and 1,1-dichloroethane (DCA) in this plume were not related to Coleman operations.

- Addendum to Coleman/Unocal Investigation, 1996[8]: Further delineation of the Unocal plume showed there are no non-detect areas between Unocal's plume and the Coleman Shipping Warehouse Building, further supporting contamination originating from an upgradient source.

- Phase III Offsite Remedial Investigation, 1997[9]: This investigation completed offsite delineation of groundwater impacts related to Coleman Operations and the report provides the full conceptual site model. Results suggested other sources unrelated to Coleman exist in downgradient areas beyond the property boundaries set forth in Figure 1.

[6] Geraghty & Miller, Inc., 1994, *Addendum Phase II Site Investigation Coleman Northeast Plant, Wichita, Kansas*, November.
[7] Geraghty & Miller, Inc., 1995, *Environmental Investigation, Coleman/Unocal Investigative Area, Coleman Northeast Plant, Wichita, Kansas, September 29.*
[8] Geraghty & Miller, Inc., 1996, *Addendum to Environmental Investigation, Coleman/Unocal Investigative Area, Coleman Northeast Plant, Wichita, Kansas, June 17.*
[9] Geraghty & Miller, Inc., 1997, *Phase III Offsite Remedial Investigation, Coleman Northeast Plant, Wichita, Kansas, February 27, 1997.*

COCs currently detected above Tier 2 RSKs in groundwater include PCE; TCE; cis-1,2-DCE; trans-1,2-DCE; 1,1-DCE; 1,1-DCA; and vinyl chloride. Maximum concentrations and recent concentrations of these constituents are presented in Tables 1 and 2. The most recent monitoring results of chlorinated VOCs are depicted in Figure 3. A TCE isoconcentration map showing the Site's groundwater contamination in context with the NIC Site is shown in Figure 4. The Site's COC Concentration map is shown in Figure 5.

## 4. Source Abatement and Interim Remedial Measures

IRMs are actions or activities taken to quickly prevent, mitigate, or remedy unacceptable risk(s) posed to human health and/or the environment by an actual or potential release of a hazardous substance, pollutant, or contaminant. Various IRMs have been implemented and some are still in operation. Coleman has completed the following IRMs:

### *4.1 Groundwater Extraction and Treatment (Site Wide)*

A groundwater pump and treat system installed in 1995 addresses source area contamination and provides hydraulic control and containment. The system extracts groundwater from three recovery wells, treats it through an air stripper, and discharges it via a permitted discharge, National Pollutant Discharge Elimination System Kansas permit number I-AR94-PO70. Recovery well operational parameters have been recorded on a monthly basis since initial start-up of the remedial system. Total average monthly flow for late 2015 ranged from 86 to 90 gpm. Remedial system upgrades in January 2015 replaced equipment that was installed in 1995. All new equipment was brought online during the first half of 2015.

### *4.2 Capping (Site 3)*

In 1995 a liner was placed over Site 3 to limit site workers' contact with impacted soils. Later landscaping, associated with nearby construction activities, placed an additional two to five feet of soil over Site 3. VOC concentrations in groundwater samples collected from a monitoring well located immediately downgradient of Site 3 (MW-15S) declined by two orders of magnitude immediately after liner installation, demonstrating the liner effectively minimizes infiltration and the resulting mobilization of residual VOCs.

### *4.3 Soil Vapor Extraction Pilot Test (Site 3)*

In 2005 ARCADIS conducted soil vapor extraction (SVE) pilot testing at Site 3. The testing indicated that while soil vapors could be successfully extracted and that a significant vacuum response could be generated within the test area, vapor response within predominantly clay soils was limited. Residual VOC concentrations were highest in clay soils within and immediately above the capillary fringe. Therefore, it was determined that SVE was unlikely to be effective in addressing source VOC mass in Site 3.

### 4.4 Soil Shredding (Site 1B)

During 2003 and 2004, ARCADIS remediated unsaturated soil at both areas in Site 1B after a pilot test in 2002. The primary objective was to reduce the VOC concentration in the upper 15 feet of the unsaturated zone soils to levels below the Tier 2 levels for TCE, 1,2-DCE, and 1,1-DCE. Wet to saturated soils were encountered approximately 16 feet bgs. The action removed approximately 5,725 cubic yards of unsaturated soils and stockpiled it for soil shredding inside the lined staging/treatment area. The soil shredder aerated the untreated soils through a mechanical shredding/grinding process which resulted in the formation of soil granules that typically ranged from sand size to about 2/3-inch diameter.

After sampling to verify that VOC concentrations were reduced below treatment standards, the soil was returned to the excavation as backfill. Prior to replacing the treated silty clays, a 1-foot-thick sand layer was placed in the base of the excavation to serve as an infiltration gallery during possible future in situ treatment of the underlying soil and groundwater. The remediation activities successfully treated soils within the excavation to a depth of approximately 16 feet bgs. Residual VOC impacts remained in the saturated fine grained soils at a depth of approximately 22 feet bgs (6 feet below the base of the excavation), where the soil becomes sandy and little sorbed mass remains.[10]

### 4.5 Enhanced Reductive Dechlorination (Site 1B)

In 2007 and 2008, ARCADIS conducted an initial ERD pilot test by injecting a carbon solution in order to create reducing conditions for the degradation of chlorinated compounds. The injections were placed in the excavation backfill (from 2003) at the top of the water table.[11] In 2010 and 2011, they conducted additional ERD pilot testing in the underlying sand aquifer.[12] The testing demonstrated the overall effectiveness of ERD to remediate the dissolved-phase VOC plume and indicated the potential for a sustained in situ reactive zone to address source mass below Site 1B.

ARCADIS conducted an expanded injection program with four injection events in 2012-2014 to evaluate the potential for full-scale implementation of ERD. Although the injections did not result in elevated carbon concentrations in the underlying sand aquifer, there was a reduction in overall VOCs and a transition from TCE to daughter products (1,2-DCE and vinyl chloride) in monitoring wells completed in the sand aquifer and immediately downgradient of the northwest injection area.

Groundwater samples collected from four monitoring wells in the vicinity indicated a continued decline in TCE concentrations as well as a relative increase in degradation compounds. While there is no direct evidence that sorbed mass within the low-permeability sediments is being

[10] ARCADIS, 2004, *Remediation Summary of Site 1B Soil Shedding Project, Coleman Northeast Plant, Wichita, Kansas*, April 22.
[11] ARCADIS 2008, *Enhanced Reductive Dechlorination Pilot Test Report for Site 1B, Coleman Northeast Plant, Wichita, Kansas*, November.
[12] ARCADIS, 2012, *Sand Aquifer Enhanced Reductive Dechlorination Pilot Test Report for Site B, Coleman Northeast Plant, Wichita, Kansas.* April.

removed, the progressively lower rebound in VOC concentrations and the persistent transition to daughter products from TCE indicate that source reduction occurs during the injections and continues for an extended period of time after injections are complete. Overall, the pilot testing has documented that ERD is a viable remedial technology for the Site.

### 4.6 Groundwater Monitoring

As part of the remedial system performance evaluation, semi-annual groundwater quality monitoring has been used to evaluate the effects of groundwater pumping on the nature and extent of chlorinated VOCs in groundwater. A summary of the current semi-annual monitoring data, comparing contaminant levels to their Tier 2 RSKs for groundwater, is included in Table 2 and Figure 5.

## 5. Site Risks and Receptors

COCs detected during the investigation phases were compared to their respective concentrations in the Tier 2 Risk-Based Summary Table in Appendix A of the KDHE RSK Manual to determine if the chemical- and media-specific concentrations are protective of human health and the environment.

The soil pathway addresses the impact to human health via ingestion of contaminated soil, inhalation of fugitive emissions or dusts, and dermal contact with contaminated soil. The soil shredding activities, which were implemented as IRMs, reduce the potential for exposure to impacted soil. Facility source area surface soils that have been excavated and treated now have COC levels below the Tier 2 RSKs for the soil pathway, indicating that there is no unacceptable human health or environmental exposure risks from contact with the soil. COCs above the Tier 2 RSKs for the soil-to-groundwater pathway indicate that a continuing source of contamination may still be present.

Groundwater contaminated with chlorinated solvents at concentrations exceeding their respective Tier 2 RSKs poses the primary route for potential exposure if used for drinking or other household uses. The City of Wichita Municipal Code of Ordinances, Title 7, Chapter 7.30, Section 7.30.105 currently prohibits the installation of new wells and use of pre-existing water wells for personal use in contaminated areas. Therefore, there is no unacceptable human health or environment exposure risk due to the incomplete groundwater pathway.

Chlorinated solvents are volatile and mobile; subsequently, vapor migration in the subsurface is generally a concern. Unsaturated utility trench backfill material and permeable vadose zone soils are typical vapor migration paths. Underground utilities also present potential conduit routes for vapors to migrate (e.g., storm sewer, electric, and water lines). Vapor intrusion was determined to be an incomplete pathway in the NIC site-wide vapor intrusion assessment.[13]

[13] CDM Smith, 2012, *North Industrial Corridor Site-Wide Vapor Intrusion Assessment*, Wichita, May.

# 6. Remedial Action Objectives

Remedial Action Objectives (RAOs) are media-specific goals for protecting human health and the environment. RAOs are developed through evaluation of *Applicable and Relevant and Appropriate Requirements* (ARARs) and *To Be Considered* standards with consideration of the findings of the investigations. Based on this information, ARCADIS developed the following RAOs:

- Prevent the potential for ingestion or inhalation by construction workers.
- Mitigate potential for TCE present in soil to leach to groundwater.
- Prevent ingestion of, and dermal contact with, impacted groundwater.
- Prevent inhalation of vapors off-gassing from impacted groundwater.
- Prevent groundwater with COCs present in concentrations above acceptable levels from migrating offsite (protective of current and future offsite workers and future adult and child residents).
- Reduce contaminant concentrations in groundwater at the Coleman facility to acceptable levels at the property boundary.

## *6.1 Cleanup Levels*

Federally promulgated Maximum Contaminant Levels (MCLs) are used as the cleanup levels for groundwater remediation of drinking water aquifers. Groundwater in the vicinity is not currently used for drinking purposes; however, it has historically been used as a drinking water source and is a potential source of drinking water in the future. Therefore Tier 2 RSKs (equivalent to MCLs) are the remedial goals for groundwater. The soil-to-groundwater pathway levels will be used for soil to prevent further degradation to groundwater. Tables 1 and 2 summarize the Tier 2 RSKs for contaminants in soil and groundwater, respectively.

Site-specific risk-based concentrations, also known as alternative clean-up levels, can be used where applicable. The exposure pathways identified in the site-specific risk assessments as exceeding accepted hazard indices or cancer risks may be used to assess the adequacy of the proposed remedial alternatives. Because the City of Wichita has restrictions in place precluding the use of groundwater for drinking purposes, an alternate treatment goal (ATG) has been established for TCE of 21 μg/L within the boundaries of the NIC Site. The ATG is intended to focus on the areas of the NIC site where remediation is required; however, continued remedial system operations beyond these levels or cleanup activities in other areas may be necessary to control plume migration, mitigate impacts to other environmental media, and/or as otherwise needed to protect human health and the environment.[14]

The conclusions of the investigation, the formulation of RAOs, and the determination of Tier 2 RSKs as the cleanup levels for soil and groundwater provide the basis for selecting a preferred remedial alternative.

## 7. Summary of Remedial Alternatives Evaluated

In accordance with KDHE's CAS Scope of Work, several remedial action alternatives were assembled and evaluated in detail. Each remedial alternative was evaluated with respect to their ability to satisfy the following criteria as specified in the *National Oil and Hazardous Substances Contingency Plan*[15] *(NCP)*: overall protection of human health and the environment; compliance with federal and state ARARs; long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; short-term effectiveness; implementability; and cost. The remedial action alternatives were then compared against one another to facilitate the identification of the preferred alternative.

The objective of the CAS is to identify remedial technologies and practices that can meet the site-specific RAOs and then combine the technologies and practices into a suite of remedial alternatives for further evaluation. A detailed description of each remedial action alternative and the individual and comparative analyses is presented in the CAS. Each remedial alternative evaluated also includes the IRMs already implemented at the Site.

Three remedial action alternatives for groundwater were evaluated, which include: Alternative 1 – No Action; Alternative 2 – MNA, Institutional Controls, Hydraulic Containment, In-Situ ERD at Site 1B, and In-Situ Chemical Oxidation at Site 3; and Alternative 3 – MNA, Institutional Controls, Hydraulic Containment, and In-Situ ERD at Site 1B and Site 3. Three remedial action alternatives for soil were evaluated, which include Alternative 1 – No Action; Alternative 2 – Institutional Actions and Excavation; and Alternative 3 – Institutional Controls and Capping (Liner Repair).

Any remedial action that results in contaminants remaining on-site at concentrations greater than those allowing unrestricted use must be reviewed at least once every five years. During five-year site reviews, KDHE assesses whether the implemented remedy continues to be protective of human health and the environment or whether the implementation of additional remedial action is appropriate.

Brief summaries of the remedial action alternatives are provided below.

---

[14] KDHE, 2012, *Final Corrective Action Decision for Interim Groundwater Remediation, North Industrial Corridor Site, Wichita, Kansas*, March 28.

[15] National Oil and Hazardous Substances Contingency Plan, 40 CFR 300 et seq.

## 7.1 Groundwater Remedial Action Alternatives

### 7.1.1 Alternative 1 – No Action

The NCP requires the evaluation of a "No Action" alternative to serve as a baseline for comparison to other remedial action alternatives evaluated. The "No Action" alternative generally assumes that the Site is left unchanged; no further actions would be taken to reduce contaminant mass, address potential exposure pathways, or reduce the potential for contaminant migration. Since no remedial action is taken, risks to human health and environment may not be addressed. This alternative is considered as a baseline from which to compare the other alternatives. The present value cost for this alternative is $0 since no action is proposed.

### 7.1.2 Alternative 2 – MNA, Institutional Controls, Hydraulic Containment, In-Situ ERD at Site 1B, and In-Situ Chemical Oxidation at Site 3

This alternative includes MNA with monitoring of existing groundwater monitoring wells. Based on the review of available data, it appears that natural attenuation is contributing towards contaminant mass reduction and plume control. Groundwater samples would be collected from a network of monitoring wells and analyzed for PCE, and TCE, and degradation products (DCE, vinyl chloride, and ethene) to confirm the effectiveness of MNA.

**Highlight 7-1 – Monitored Natural Attenuation**

Monitored Natural Attenuation (MNA) relies on a suite of natural attenuation processes to reduce contaminant concentrations to acceptable levels. Primary natural attenuation processes include biodegradation, dispersion, dilution, and absorption. KDHE and the United States Environmental Protection Agency have taken the position that the biological component must be active to support selection of MNA alone as the preferred remedy.

Institutional controls would be implemented to restrict future uses of the Site to industrial uses, control access to the areas of concern, and prevent the use of groundwater. These restrictions would be applied to the affected area including enough area surrounding the impacted areas to ensure RAOs are satisfied. These restrictions would include: 1) filing an Environmental Use Control (EUC) in accordance with KDHE requirements that will remain on the property as long as COCs pose a potential risk; 2) compliance with the provisions of CERCLA Section 120(h)(3) or other applicable statutory requirements in the event of property transfer; and 3) recording the restriction at the local county recorder of deeds office.

Hydraulic containment with a pump and treat system would continue to remove mass and limit off-site migration. Tracking declining COC concentrations over time assists in determining the point at which no further action is necessary to meet the RAOs.

Further ERD injections for Site 1B would be used to treat "hot spots" remaining in the area significantly above Tier 2 RSK residential soil-to-groundwater levels. Eighteen injection wells covering the area would maximize the efficiency of the carbon source delivery. Routine injection of dilute organic carbon substrate solution would stimulate naturally-occurring microorganisms, deplete oxygen and other available electron acceptors, and thereby establish and maintain anaerobic and reducing conditions. The effectiveness of the ERD treatment would be evaluated by the ongoing periodic site monitoring.

In-Situ Chemical Oxidation (ISCO) for Site 3 involves the injection or direct mixing of reactive chemical oxidants into groundwater and soil for the primary purpose of rapid and complete contaminant destruction. ISCO is a versatile treatment technology most often deployed in source zones characterized by moderate to high contaminant concentrations in groundwater, significant sorbed contamination, and the potential presence of residual, separate-phase contamination. The actual design of the ISCO system would be established following the implementation of an ISCO pilot test. A series of temporary injection points or permanent injection wells would be installed within and upgradient of the source area to fully develop the treatment zone. These ISCO treatment lines would extend from near the water table to a depth of approximately 25 feet bgs in order to treat the full vertical extent of the dissolved-phase plume as well as smear and saturated zone soils. Successful treatment of source zones requires a detailed understanding of the nature and distribution of contaminant mass as well as an aggressive application approach that will maximize oxidant-contaminant contact and deliver a sufficient amount of oxidant to treat dissolved, sorbed, and separate-phase contaminants. Disadvantages of chemical oxidation include: the environment is not favorable to bioremediation after the chemical oxidant is spent, significant heat is produced from the chemical reactions, energy is wasted on non-productive chemical reactions, acidic conditions are necessary (pH dependent), fast reactions, short transport distance, metals mobility, difficulty in achieving favorable conditions for contaminant oxidation, difficult in tight soils, success depends on the distribution and contact with the chemical oxidant, and the use of dangerous chemicals (safety handling issues).

### Highlight 7-2 – In-Situ Chemical Oxidation

ISCO uses chemicals called “oxidants” to help change harmful contaminants into less toxic ones. It is commonly described as “in situ” because it is conducted in place, without having to excavate soil or pump out groundwater for aboveground cleanup. The oxidants are typically injected underground by pumping them into wells. Once the oxidant is pumped down the wells, it spreads into the surrounding soil and groundwater where it mixes and reacts with contaminants.

Based on professional judgment, it is estimated that the timeframe for COC concentrations to decline to less than the Tier 2 RSKs is 15 years. The present value cost to implement Alternative 2 is $1,735,000.

### 7.1.3 Alternative 3 – MNA, Institutional Controls, Hydraulic Containment, In-Situ ERD at Site 1B and Site 3

This remedial alternative is the same as Alternative 2 except Site 3 involves ERD Treatment instead of ISCO.

ERD injections would be implemented to reduce chlorinated VOC concentrations in groundwater at Site 3 that have not been addressed by the hydraulic containment system. The actual design of the ERD system would be established following the successful completion of an ERD pilot test. Based on the results of the ERD pilot test, a series of temporary injection points or permanent injection wells would be installed within and upgradient of the source area to fully develop the treatment zone. These ERD treatment lines would extend from near the water table to a depth of approximately 25 feet bgs in order to treat the full vertical extent of the dissolved-phase plume as well as smear zone soils. Routine injection of dilute organic carbon substrate solution would stimulate naturally-occurring microorganisms, deplete oxygen and other available electron acceptors, and thereby establish and maintain anaerobic and reducing conditions.

**Highlight 7-3 – Enhanced Reductive Dechlorination**

Enhanced reductive dechlorination (ERD) is a type of bioremediation that breaks down chlorinated organic compounds in the subsurface through natural biological processes. In order for bioremediation to be successful, the right microbes, nutrients, temperature and amount of oxygen must be present. Different microbes are needed depending on the contaminants present at a site.

Because remediation is conducted in the subsurface, bioremediation-based remedies largely reduce the amount of wastes generated from a contaminated site.

Based on professional judgment, it is estimated that the timeframe for COC concentrations to decline to less than the Tier 2 RSKs is 15 years. The present value cost to implement Alternative 3 is $1,617,000.

## 7.2 Soil Remedial Action Alternatives

### 7.2.1 Alternative 1 – No Action

The NCP requires the evaluation of a “No Action” alternative to serve as a baseline for comparison to other remedial action alternatives evaluated. The “No Action” alternative generally assumes that the Site is left unchanged; no further actions would be taken to reduce contaminant mass, address potential exposure pathways, or reduce the potential for contaminant migration. Since no remedial action is taken, risks to human health and environment may not be addressed. This alternative is considered as a baseline from which to compare the other alternatives. The present value cost for this alternative is $0 since no action is proposed.

#### 7.2.2 Alternative 2 – Institutional Actions and Excavation

Institutional controls would be implemented to restrict future uses of the Site to industrial uses and control access to the areas of concern to ensure RAOs are satisfied. These restrictions would include filing an EUC in accordance with KDHE requirements that will remain on the property as long as COCs pose a potential risk.

Excavation involves the removal and transport of impacted soil from Site 3 to a permitted off-site location for disposal and/or treatment. Soil excavation is an accepted method for soil remediation and has the advantage of rapid removal of residual contaminants that act as sources of groundwater contamination. Excavation has been shown to be a reliable, quick, and cost-effective method currently available for treatment of contaminated soils with very low hydraulic conductivities. The potential risks involved in excavation are predominately related to the equipment used in soil removal, the potential caving hazards around the open excavation, and the presence of a buried high voltage electrical line through the center of Site 3. The high voltage electrical line will also limit the effectiveness of excavation, requiring a significant amount of source mass to remain in place below the line. After the limits of the excavation have been reached, verification samples will be collected to evaluate the effectiveness of the remediation activities, and to determine if additional activities are necessary.

Based on professional judgment, it is estimated that source treatment will shorten the timeframe for COC concentrations to decline to less than the Tier 2 RSKs in 15 years. The present value cost to implement Alternative 2 is $1,615,000.

#### 7.2.3 Alternative 3 – Institutional Controls and Capping (Liner Repair)

This remedial alternative is the same as Alternative 2 except capping is the remedy instead of excavation. A prime consideration when installing a liner is its effectiveness in preventing infiltration. As documented by previous groundwater monitoring results, an intact liner is effective in minimizing infiltration and resulting mobilization of dissolved VOCs. Repair and proper maintenance is expected to return the liner to its previous performance.

Based on professional judgment, it is estimated that source treatment will shorten the timeframe for COC concentrations to decline to less than the Tier 2 RSKs in 15 years. The present value cost to implement Alternative 3 is $94,000.

## 8. Description of the Preferred Remedy

KDHE evaluated each corrective action alternative individually and comparatively while considering the threshold and balancing criteria discussed in Section 7.0. On the basis of information available in the Administrative Record and summarized above, KDHE has selected Alternative 3 for groundwater and Alternative 3 for soil as the preferred remedy. The results of the comparative analysis support the preferred remedy for the Site as outlined below. The total present value cost of the preferred remedy is $1,709,000 as presented in Table 3, not including IRMs implemented to date. The results of the IRMs completed over the past several years have confirmed the effectiveness of the approaches in this alternative. The preferred remedy as outlined below satisfies or meets Federal, State, and local requirements, and will be protective of human health and the environment.

### 8.1 Elements of the Preferred Remedy

Elements of KDHE's preferred remedy (Alternative 3 for both soil and groundwater) are summarized below:

- *Capping/Liner Repair:* Capping is the remedy instead of excavation. A prime consideration when installing a liner is its effectiveness in preventing infiltration. As documented by previous groundwater monitoring results, an intact liner is effective in minimizing infiltration and resulting mobilization of dissolved VOCs. Repair and proper maintenance is expected to return the liner to its previous performance.

- *MNA:* This element involves MNA with monitoring existing groundwater monitoring wells. Based on the review of available data, it appears that natural attenuation is contributing towards contaminant mass reduction and plume control. Groundwater monitoring would be performed to confirm the effectiveness of MNA. Groundwater samples would be collected from a network of monitoring wells and analyzed for PCE, TCE, and degradation products (DCE, vinyl chloride, and ethene).

- *Institutional Controls*: An EUC Agreement would be formally established through the KDHE EUC program to protect human health and the environment from risks posed by remaining contaminants through placement of restrictions, prohibitions, and conditions on land use to reduce or eliminate potential human exposure. The EUC would be implemented to restrict future uses of the Site to industrial uses, control access to the areas of concern, and prevent the use of groundwater. These restrictions would be applied to the affected area including enough area surrounding the impacted areas to ensure RAOs are satisfied. These restrictions would include: 1) filing an EUC in accordance with the KDHE that will remain on the property as long as COCs pose a potential risk; 2) compliance with applicable statutory requirements in the event of property transfer; and 3) recording the restriction at the local county recorder of deeds office.

- *Hydraulic Containment*: This element reduces migration of impacted groundwater and reduces the contaminant mass present in the aquifer. Impacted groundwater is being recovered from three wells and treated using air stripping. The current system has operated effectively over the past 21 years. Trends in the decline of concentrations of COCs over time assist in determining the point at which no further action is necessary to meet the RAOs to protect human health and the environment.

- *ERD injections*: ERD injections would continue to be implemented for Site 1B and Site 3. Routine injection of dilute organic carbon substrate solution would stimulate naturally-occurring microorganisms, deplete oxygen and other available electron acceptors, and thereby establish and maintain anaerobic and reducing conditions. The injection and monitoring program conducted at Site 1B from 2007 through 2015 demonstrates the effectiveness of ERD in addressing the dissolved-phase VOC plume in the source area. Figure 7 shows the ERD injection well map for Site 1B. The effectiveness of the ERD treatment would be evaluated by the ongoing periodic site monitoring.

- *Five-year Site Reviews:* KDHE will conduct five-year reviews as long as contamination remains at concentrations above levels which would permit unrestricted use. These reviews provide an opportunity to review the overall protectiveness and effectiveness of the remedial strategy and whether the implementation of additional remedial action is appropriate.

- *Contingent Remedy:* KDHE will review new information as it becomes available to evaluate whether the proposed remedial plan is protective of human health and the environment. If new information suggests that contamination at or emanating from the Site poses a threat to human health and the environment, KDHE may require development and implementation of additional contingency measures.

## 9. Community Involvement

A Public Information Strategy for the Site was developed by KDHE. Public input and comment is being encouraged by KDHE throughout the process. Public notice of the availability of the draft CAD will be published in *The Wichita Eagle* and on the City of Wichita's Facebook and/or Twitter pages. In addition, KDHE has established a webpage dedicated to the Site, available online during the comment period at http://www.kdheks.gov/remedial/site_restoration/index.html. Relevant Site documents, including the draft CAD, are available on the webpage.

KDHE will select a final remedy after reviewing and considering all information submitted during the 30-day public comment period (August 22 to September 21, 2018). KDHE may modify the preferred remedy based on new information or public comments. The public is encouraged to review and comment on the preferred remedy presented in this draft CAD. As per the Public Information Strategy, if requested, KDHE will hold a public meeting during the public comment period to present information regarding the preferred remedy. Notice of the public meeting will be published in *The Wichita Eagle* and posted on KDHE's webpage dedicated to the Site and the City of Wichita's Facebook and/or Twitter pages.

Public comments on the draft CAD must be submitted in writing to KDHE during the 30-day public comment period. Written comments must be postmarked by September 21, 2018, and mailed to the name and address specified below:

Kansas Department of Health and Environment
Bureau of Environmental Remediation
Attention: Pamela Green, Environmental Specialist
1000 SW Jackson Street; Suite 410
Topeka, Kansas 66612-1367

Comments on the draft CAD may also be submitted to KDHE by electronic mail to pamela.green@ks.gov. Comments sent by electronic mail must be received by KDHE by 5:00 p.m. on September 21, 2018. All comments that are received by KDHE prior to the end of the public comment period will be addressed by KDHE in the Responsiveness Summary Section of the Final CAD.

# TABLES

*Table 1: Site-Related Maximum Soil Contaminant Concentrations in Soils Above Tier 2 RSK Levels*

| Contaminants of Concern | KDHE Tier 2 RSK Level‡ (Residential Soil-to-Groundwater Pathway) µg/kg | KDHE Tier 2 RSK Level (Residential Soil Pathway) µg/kg | Maximum Historical Concentration µg/kg |
|---|---|---|---|
| Tetrachloroethene (PCE) | 121 | 109,000 | 115 |
| Trichloroethene (TCE) | 84.2 | 5,850 | **90,600** |
| Cis-1,2-Dichloroethene | 855 | 23,000 | **51,500** |
| Trans-1,2 Dichloroethene | 1,220 | 202,000 | **10,000** (combined with cis-1,2 dichloroethene) |
| 1,1-Dichloroethene | 85.9 | 313,000 | **1,430** |
| 1,1-Dichloroethane | 269 | 46,800 | Not detected |
| Vinyl Chloride | 20.5 | 4,470 | **43** |

‡ *Tier 2 RSKs are based on the KDHE's Risk Based Standards for Kansas (RSK) Manual, October 2010 and subsequent updates.*
*µg/kg – micrograms per kilogram*
***Red bold font indicates concentrations above the Tier 2 RSK Level for the soil-to-groundwater pathway.***

*Table 2: Site-Related Historical and Current Maximum Groundwater Contaminant Concentrations*

| Chemical Compound | MCL or KDHE Tier 2 RSK Residential Level‡ µg/L | Maximum Historical Concentration µg/L | Current Maximum Concentration in September 2017* µg/L |
|---|---|---|---|
| Tetrachloroethene (PCE) | 5 | **2,400** | **50** |
| Trichloroethene (TCE) | 5 | **>40,000** | **94** |
| Cis-1,2-Dichloroethene | 70 | **30,400** | **1,700** |
| Trans-1,2 Dichloroethene | 100 | 22 | 6.3 |
| 1,1-Dichloroethene | 7 | **18,000** | <1.0 |
| 1,1-Dichloroethane | 25 | **1,100** | **33** |
| Vinyl Chloride | 2 | **6,200 J** | **440** |

‡*KDHE Tier 2 RSKs for these chemical compounds are equivalent to the federal MCLs.*
*µg/L – micrograms per Liter*
*Data from ARCADIS, *Second Half 2017 Semi-Annual Groundwater Monitoring Report*, February 20, 2018.
*"J" = laboratory estimated concentration*
***Red bold font indicates concentrations above the Tier 2 RSK.***

*Table 3: Summary and Estimated Cost of the Preferred Alternative*

| Preferred Alternative | Estimated Timeframe to Achieve Corrective Action Goals | Present Value Cost |
|---|---|---|
| Soil Capping/Liner Repair | 15 Years | $76,700 |
| Institutional Controls for Soil | N/A | $17,300 |
| Hydraulic Containment (Pump & Treat), Institutional Controls for Groundwater, ERD Treatment | 15 years | 668,630 |
| Annual MNA and Reporting | 15 years | $917,935 |
| Decommissioning | 15 years | $28,435 |
| **Total Cost (with 7% discount rate)** | **(Net Present Value)** | **$1,709,000** |

*Costs estimated by ARCADIS. Costs presented do not include IRMs already conducted and additional contingency implementation if this alternative needs to be supplemented.*

## *FIGURES*

*Figure 1: Site Location Map*

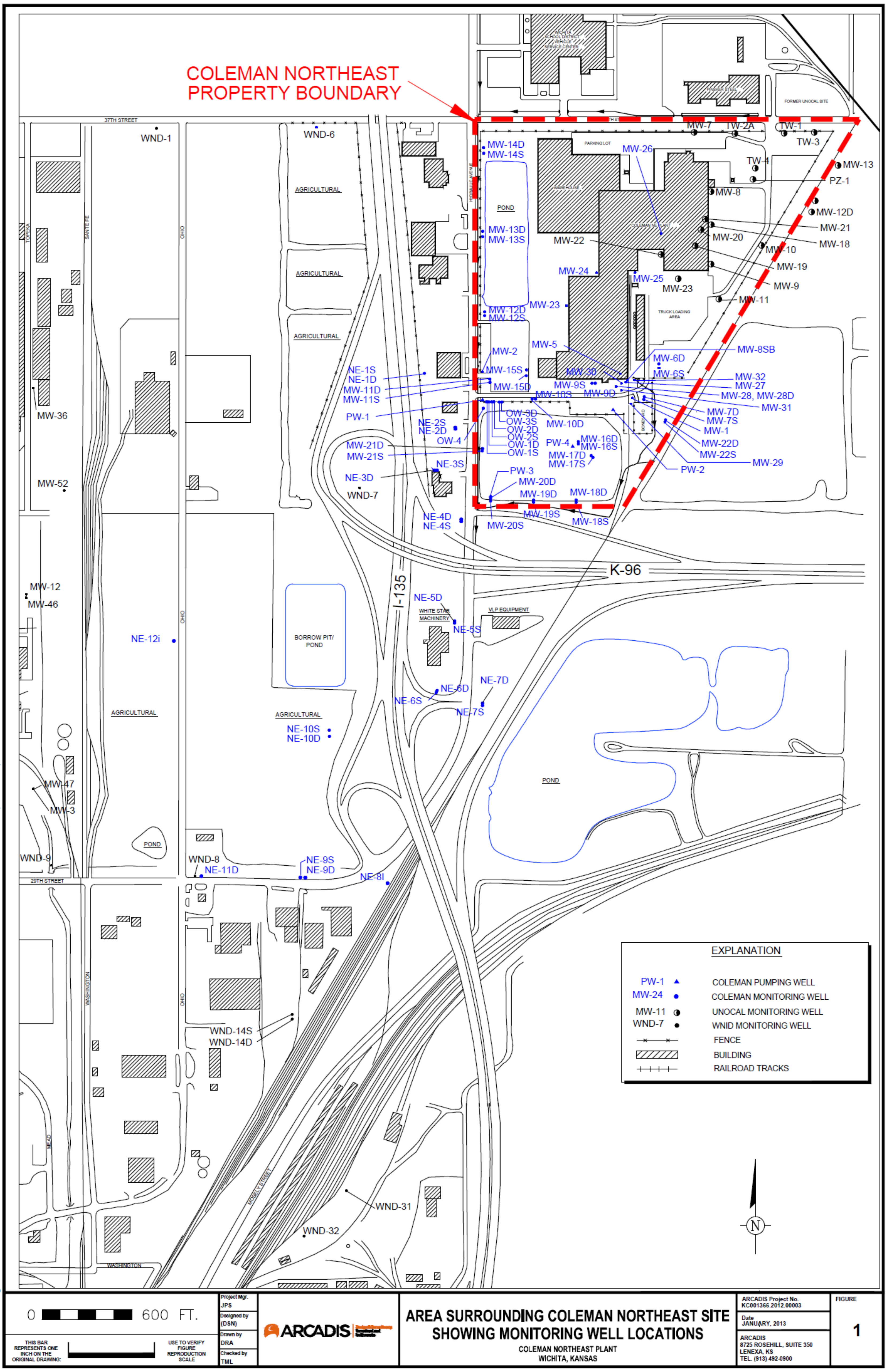
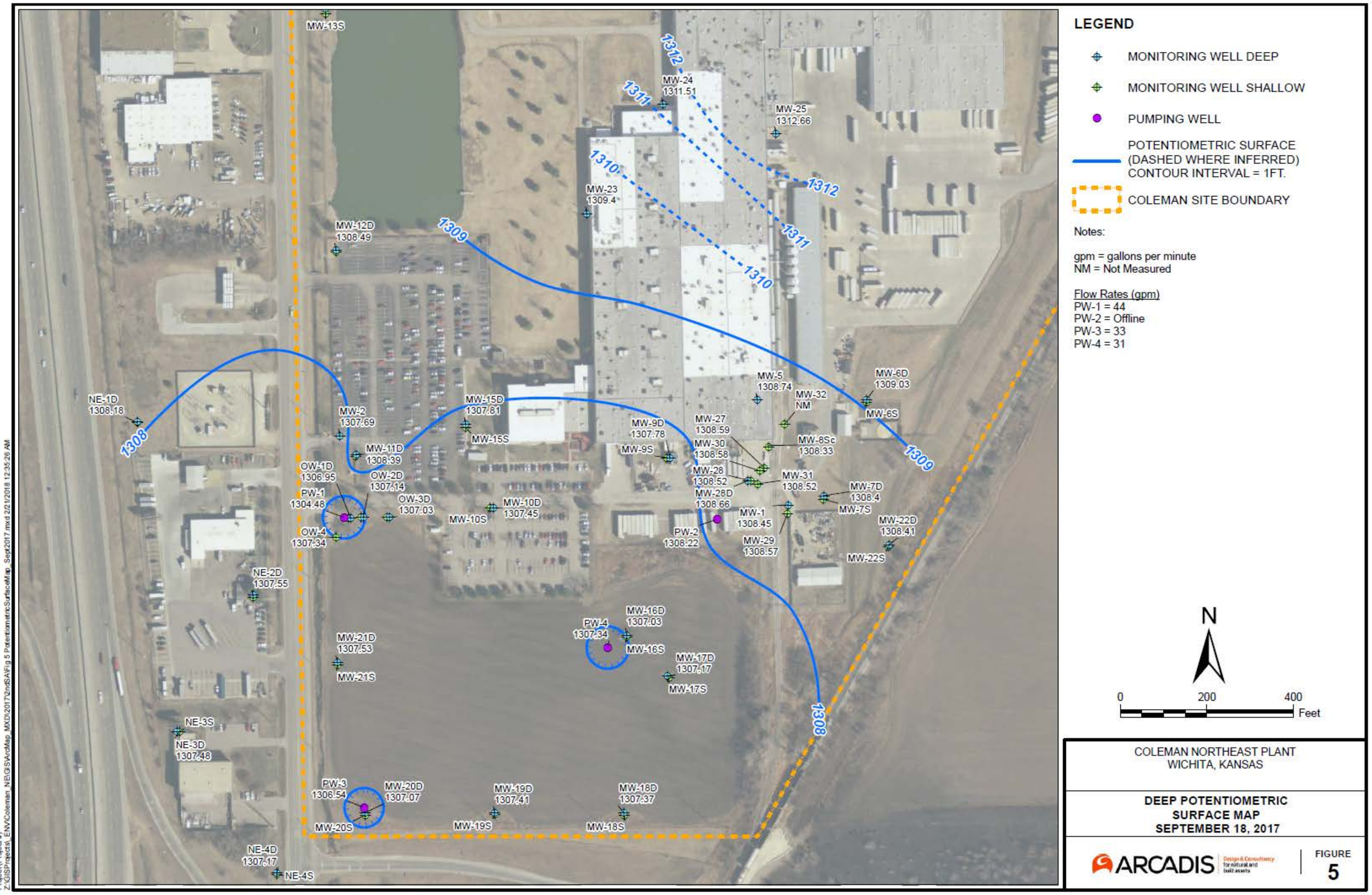



Figure prepared ARCADIS on behalf of The Coleman Company, based on figure from the *Corrective Action Study*, April 29, 2016.

*Figure 2: Site Layout Map*


Figure prepared ARCADIS on behalf of The Coleman Company, based on figure from the *Corrective Action Study*, April 29, 2016.

## *Figure 3: Potentiometric Surface Map, September 2017*




Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure prepared ARCADIS on behalf of The Coleman Company, based on figure from the *2nd 2017 Progress & Remedial System Performance Report*, Feb. 20, 2018.

*Figure 4: TCE Concentration Distribution in NIC*

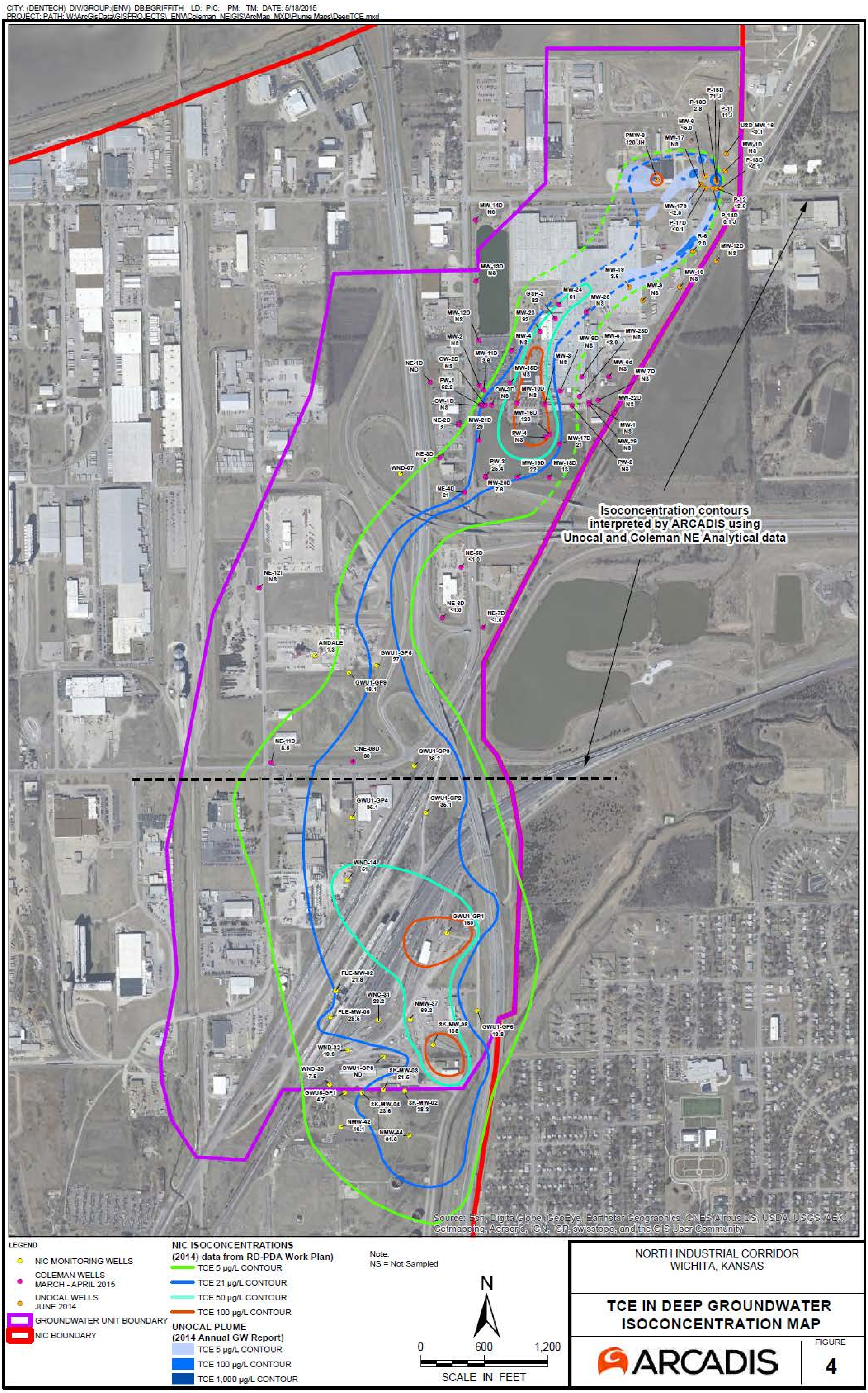
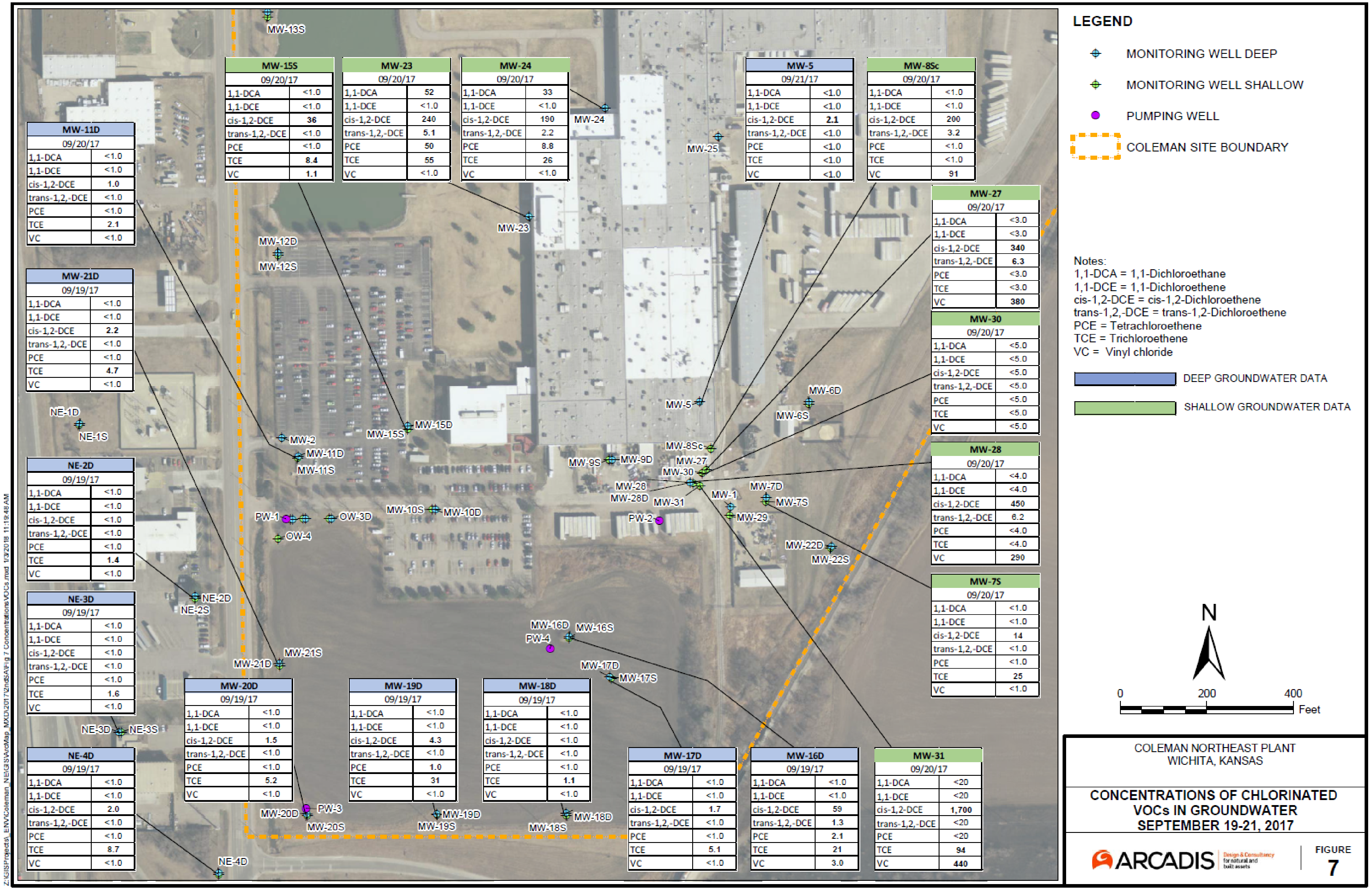



Figure prepared ARCADIS on behalf of The Coleman Company, based on figure from the *Corrective Action Study*, April 29, 2016.

*Figure 5: COC Concentration Distribution*




Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure prepared ARCADIS on behalf of The Coleman Company, based on figure from the 2nd *2017 Progress & Remedial System Performance Report*, Feb. 20, 2018.

*Figure 6: Hydraulic Containment, Pump & Treat System – Capture Zone Map*

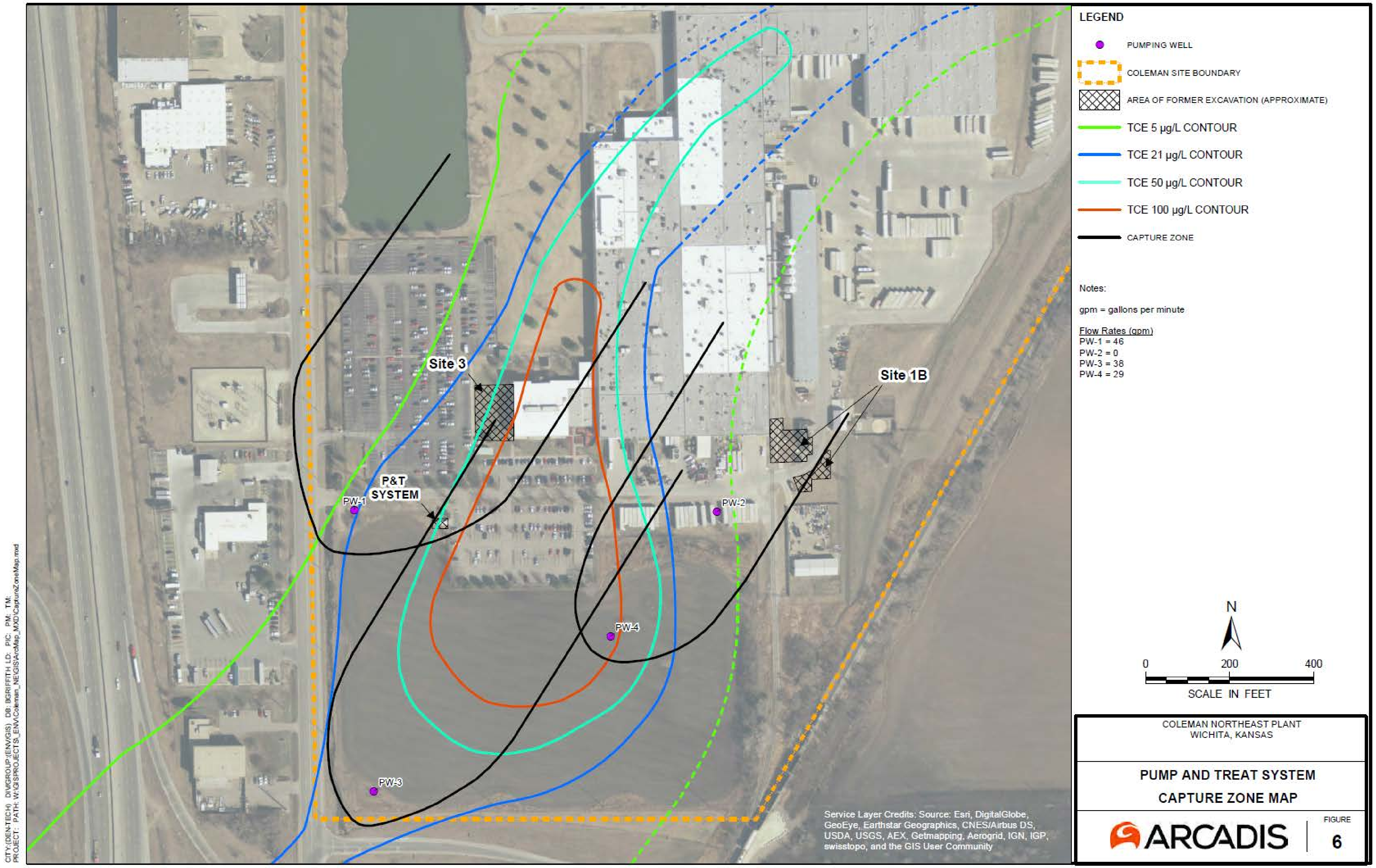



Figure prepared ARCADIS on behalf of The Coleman Company, based on figure from the *Corrective Action Study*, April 29, 2016.

*Figure 7: ERD Injection Well Map, Site 1B*

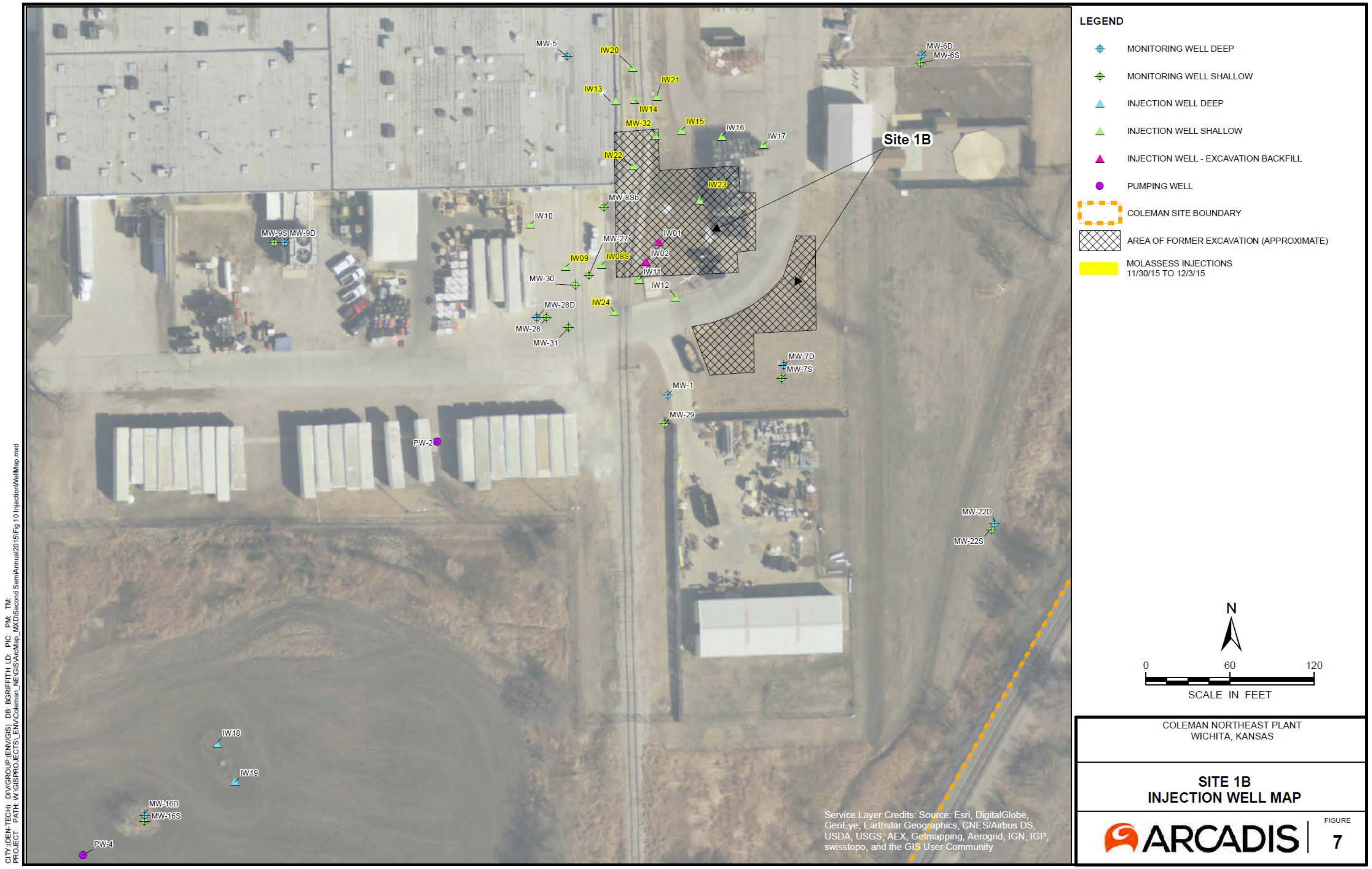



Figure prepared ARCADIS on behalf of The Coleman Company, based on figure from the *Corrective Action Study*, April 29, 2016.